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POST-DISASTER: AN OPPORTUNITY TO ADDRESS SUSTAINABLE RECONSTRUCTION, BASED ON THE 2010 CHILE EARTHQUAKE

INTRODUCTION

On Friday 27th February 2010 at 3:40 am, a terrible earthquake measuring 8.8 on the Richter scale rocked the central territory of Chile. Hours later a terrible Tsunami hit a large part of its coastal region. This event spanned a longitude of 630 km causing damages in at least six regions of the country which concentrate 75% of national population. Besides the destruction and all the panic, the quake caused an instantaneous black out for more than four days. As a result of this black out, cities suffered severe difficulties related to provisions, communication and safety, to name a few. This situation demonstrated the vulnerability of Chile electrical grid and the people's dependence of energy.

Fig. 1 Damaged caused by the earthquake

According to data from National Reconstruction Plan (2010) the number of damaged houses reached 370,051 generating enormous work in rebuilding not only houses, but entire communities and town, each of which had particular way of life.

It is important to mention the destruction of many major historic centers with low density residential communities that had taken dozens of years to consolidate their cultural wealth (Letelier, 2010). That cultural richness is characterized by the diversity in its population, including people of various social classes having accesses the same services and facilities. Also, this proximity to services produced a low dependence on automobiles, keeping walking as a basic system of transportation.

As these current events imply a lot of work, questions are raised about what kind of cities can be rebuilt or what kind of neighborhoods can be developed.

PEAK OIL AND RESOURCE DEPLETION

Given the constant increase in fuel prices and the evident sign that peak oil is closer than ever, (Association for the study of Peak Oil and Gas, undated) it is necessary to rethink our current growth processes.

This and subsequent decline will produce a change in the lifestyle of millions of people who primarily base their lives on systems dependent on oil such as: transport, electricity, food, etc.

Optimistic estimates of peak production forecast that global decline will begin in 2020 or later and assume that before the crisis comes, there will be significant investments in alternative fuels, without requiring major changes in the lifestyle of the oil-consuming nations.

Likewise, increase of human population implicates a major increasing demand for land use mainly for housings and other support infrastructure development. Moreover, land is the key factor to support human activities as it is used for growing food, fuel and for development.

NEW RECONSTRUCTION PROCESS

When discussing sustainability and its relationship with urban densities and built space, a fast approach is to talk about compact cities that help to reduce travel distances as well as to improve energy efficiency in the building envelope. On the other side, there are dissentious voices regarding the idea of compact cities, because of the problems that they contract.

Regarding the destroyed cities in Chile, and after analysis the current growth of high-density suburbs and wasting more sustainable and social options that the historical centers offer, two main ideas have emerged. Making more compact and sustainable cities or to continue the current expansion of the city. Given these questions, this research aims to establish an optimal population density seen from two main points of view: non-fossil fuel dependence and the use of renewable energy sources, with the inclusion of the soil as a substantial contribution.

The focus is on four main topics:

- energy efficient measures in buildings
- solar systems like energy generation source
- electrical vehicles as a transport alternative through electricity obtained by PVs systems
- the incorporation of micro-crops in each household

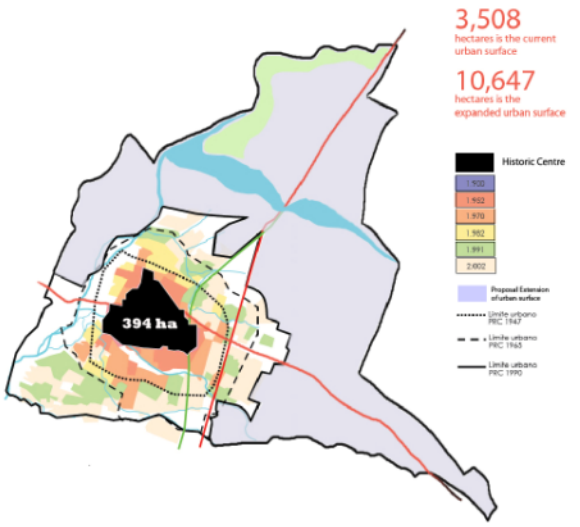

Fig. 2 Talca current growth and its new urban limit.

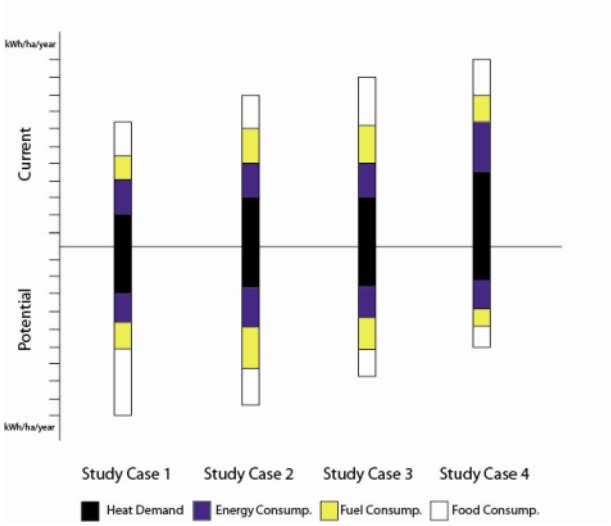

Fig. 3 Graphic diagram of expected results

Considering these main topics, an optimum range of density will be determined. The main purpose of including the "land" variable is the vital relationship between food, energy, water and land (Ng, 2010). By including these four variables in new building systems, every household will be resilient and independent in dealing with natural disasters as well as oil shortages in the near future.

STUDY CASES

For this research to be based on real cases, four different blocks in Talca City with similar characteristics in terms of population and housing but with different densities are been studied.

Each case will determine its heat demand, domestic energy consumption, as well as fuel and food consumption, all expressed in kWh/ha/year, to establish a total consumption/ha to be later countered with the potential of each block and being revitalized by the application of new technologies and energy efficiency measures.

The research will focus on Talca City as a manner of being more accessible to the available information, but the parameters and methodology used in this research could be applied to different locations and cities that are facing similar circumstances. As a result, the density studies and new renewable energy systems applied to this research could perfectly be used in cases like Christchurch and Port-au-Prince.

CONCLUSION

The opportunity exists to establish new patterns of urban growth and reconstruction based on sustainability not only understood from the point of energy efficiency, but also in the incorporation of renewable energy sources and the use of soil as a source of "generation energetic". In this way, there will be resilient neighborhoods and cities against disasters and an uncertain energy future.

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